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Milk-Production Costs In West Virginia: II.

A Study of the Costs Incurred by 36 Farms in the Huntington and Charleston Markets in 1935-36

by L. F. HERRMANN and G. A. BOWLING

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COLLEGE OF AGRICULTURE, WEST VIRGINIA UNIVERSITY
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MORGANTOWN

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This study of the Huntington and Charleston market areas is the second of a series of studies of costs of producing milk in West Virginia. The first study included the Morgantown and Fairmont market areas, and the results have been published in Bulletin 268 of this Station.

In planning these studies and in gathering the information there were three objectives: first, to determine the cost of producing milk; second, to determine the quantities of feed and labor used in producing milk; and third, to determine why some herds had low costs of production while others had high costs.

Cost-of-production figures have been in demand for use as aids in price bargaining. In order that such cost figures may be adaptable to changing prices, it is necessary to know the quantities of physical units employed — particularly feed and labor. Aside from their value as marketing information, cost-of-production figures can be analyzed to show the management factors responsible for varying costs of production. Careful management, as well as satisfactory prices, is necessary for greater profit.

Method of Collecting Data

The method of collecting the information contained in these studies was described in detail in the report of the first study. Briefly, it consisted of the selection of herds at random from among the dairymen selling milk in the market areas under consideration. Feed and production records were taken for all cows in these herds at six bimonthly visits. Inventories and cash records furnished by the dairymen completed the accounts.

Of the 36 farms studied, 15 sold their milk in Huntington and 21 sold in Charleston. The location of one of the Charleston herds was on the fringe of the Huntington area, and quite isolated from the other Charleston herds in the study. Its management was typical of herds of the Huntington area, so its record was summarized with that group.

ACKNOWLEDGMENT

Credit is hereby given to the dairymen who cooperated in making this study. Besides keeping the required financial data, they each provided meals and lodging for the fieldman during his bimonthly visits, the expenses incurred for these items representing a considerable share of the cost of the study.

Sources of income The farms of the Huntington market had an average annual gross income of $1,877.47. Of this 70.7% was received from the dairy, 19.4% from miscellaneous sources — mostly work done away from the farm, and the remainder derived largely from crops and poultry. The value of farm products used at home was not used in arriving at these figures. Table 1 shows the number of farms on which each source of income was found, the average contribution from each source, and the maximum and minimum percentage of the total income contributed by each.

Table 1—*Sources of gross income on 16 farms in the Huntington market (1935-36)*

Sources of income	Farms reporting	Ave. annual gross income	Percentage of total receipts from different sources		
			Average	Maximum	Minimum
	(*number*)	(*dollars*)	(%)	(%)	(%)
*Dairy products**	16	1,326.13	70.7	100.00	34.9
Cattle**	...	...	...	...	...
Poultry and eggs**	12	63.65	3.4	24.5	0.0
Sheep and wool**	1	1.88	0.1	1.4	0.0
Hogs**	9	—4.72†	—.3	2.1	—2.8
Grain	5	43.78	2.2	11.4	0.0
Hay	...	...	...	...	...
Other crops	6	83.00	4.4	14 2	0.0
Miscellaneous receipts	10	363.75	19.4	59.8	0.0
Total gross income	...	1,877.47	100.0	...	...

*Value of all milk sold, plus increase of dairy inventory.

**These are net increases—sum of purchases plus value at beginning of year subtracted from sum of sales plus value at the end of year. Value of products used by household is not included.

†Since the value of farm products used at home was not used in arriving at gross income, in some enterprises, particularly hogs kept only for home use, the sum of purchases plus the value of the beginning inventory was often less than the sum of sales plus the ending inventory. As a result some enterprises showed an average loss.

The farms studied in the Charleston market area had both larger acreages and larger herds than farms in the Huntington market area. The average annual gross income of farms in the Charleston area was $4,557.14. Of this amount 87.5% came from the dairy, 5.8% from miscellaneous sources, and small amounts from crops and livestock other than the dairy herd (Table 2).

For both markets, the gross incomes indicate that dairy and poultry were the important livestock enterprises, but that crops contributed appreciable amounts to the farm income on some farms.

Number of livestock kept The difference in numbers of dairy cattle per farm explains part of the difference of income between the Huntington and Charleston groups. The number of cows kept on Huntington farms, expressed as cow years, ranged from 5.0 to 32.8. Only three farms kept 14 or more, however, and the average number of cows for all farms was only 12.3. Livestock other than dairy cattle was of minor importance on the Huntington farms.

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TABLE 2—*Sources of gross income on 20 farms in the Charleston market (1935-36)*

Sources of income	Farms reporting	Ave. annual gross income	Percentage of total receipts from different sources		
			Average	Maximum	Minimum
	(*number*)	(*dollars*)	(%)	(%)	(%)
*Dairy products**	20	3,986.85	87.5	100.0	57.0
Cattle**	4	—9.50†	—.2	0.0	—1.6
Poultry and eggs**	16	99.09	2.2	26.4	0.0
Sheep and wool**	2	—1.40†	...	1.5	—.3
Hogs**	12	—3.30†	—.1	.7	—1.2
Grain	8	114.72	2.5	16.0	0.0
Hay	4	37.40	.8	7.3	0.0
Other crops	4	68.75	1.5	17.5	0.0
Miscellaneous receipts	8	264.50	5.8	32.6	0.0
Total gross income	...	4,557.14	100.0	...	...

*Value of all milk sold, plus increase of dairy inventory.

**These are net increases—sum of purchases plus value at beginning of year subtracted from sum of sales plus value at end of year. Value of products used by household is not included.

†See footnote, Table 1.

Likewise, livestock other than dairy cattle was unimportant on the Charleston farms. The dairy herds, however, averaged 22.2 cow years per farm, ranging from 8.3 to 53.5. Only two herds studied in the Charleston market had fewer than 14 cows (Table 3).

Crop practices and use made of farm land

It is not possible to generalize on the land utilization of farms in the study. The averages given in Table 4 show 73.6 acres of crop land per farm in the Huntington area. However, four of the 16 farms were in the Ohio River valley in the northern part of Cabell county. They each had 100 acres or more of crop land. Of the remaining 12 farms, only one had more than 34 acres of crop land. Those farms lying along the Ohio River were able to grow considerable acreages of corn, hay, and small grains; more than enough for their own feed requirements. Only occasional farms in other parts of the Huntington area were able to raise as much feed as was needed for their livestock.

The farms studied in the Charleston market represent a considerable range in size, from 22 to 651 acres. The farms in Kanawha county

TABLE 3—*Livestock on farms (1935-36)*

Item	Amount of stock per farm					
	16 Huntington farms			20 Charleston farms		
	Average	Maximum	Minimum	Average	Maximum	Minimum
Milk cows cow-years*	12.3	32.8	5.0	22.2	53.5	8.3
Heifers, calves, and bulls	4.7	13.0	0.0	6.8	29.5	1.0
Beef cattle	...	...	0.0	1.1	11.0	0.0
Poultry	67.7	230.0	0.0	73.5	250.0	0.0
Sheep	1.4	22.5	0.0	.8	13.0	0.0
Hogs	2.9	18.5	0.0	3.3	20.0	0.0
Horses, mules, and colts	2.6	11.0	0.0	4.2	13.0	0.0

*Average number of cows kept during the year. For example, two cows kept for six months each would equal one cow-year.

and those closest to Charleston in Jackson county tended to be small and of a limited crop acreage. They purchased practically all their grain and some of their roughage. Farther from Charleston in Jackson county, and in Mason county, the farms were larger and had more than enough crop land to raise the feed required by their dairy herds. Most of the herds studied were in this location. Most of Charleston's pasteurized milk came from this area, the dairymen closer in to Charleston being mostly producer-distributors of natural milk. The average size of all farms studied in the Charleston market was 325.6 acres, including 91.1 acres of crop land and 180.9 acres of dairy pasture. All but three of the 20 Charleston area farms raised alfalfa or soybeans, and only one farm raised no legume hay of any kind.

TABLE 4—*Utilization of land area (1935-36)*

Item	16 Huntington farms		20 Charleston farms	
	Acres	Percent of total area	Acres	Percent of total area
Crop land:				
Corn, for grain	14.8	5.8	17.7	5.4
Corn, for silage	3.3	1.3	6.4	2.0
Oats	.6	.2	...	...
Wheat	7.8	3.0	16.2	5.0
Potatoes	.3	.1	.6	.2
Legume hay	12.3	4.8	22.8	7.0
Non-legume hay	8.3	3.2	19.5	6.0
Other crops	2.4	.9	1.4	.4
Idle crop land	23.7	9.3	6.5	2.0
Total crop land	73.6	28.6	91.1	28.0
Orchard	.6	.2	.4	.1
Dairy pasture	111.9	43.7	180.9	55.6
Other pasture	12.2	4.7	15.1	4.6
Woods	20.1	7.8	29.2	9.0
Waste	35.2	13.7	5.5	1.7
Farmstead	3.4	1.3	3.4	1.0
Total	256.9	100.0	325.6	100.0

Crop yields Crop yields are indicative partly of the productivity of the farms and partly of the weather conditions during the crop year of 1935. Yields of corn, both grain and silage, were very low in both market areas, averaging 16.2 bushels of grain and 5.9 tons of silage on Huntington farms, 19.4 bushels of grain and 6.5 tons of silage on Charleston farms. Unfavorable weather during this year undoubtedly reduced these corn yields below normal. Hay yields were good, however, except for alfalfa and soybeans (Table 5).

The foregoing information has been presented to describe the conditions under which the dairy enterprise was conducted in these two markets. In so far as the farms studied are representative, the data indicate that dairying in these areas is carried on by two groups of farms: (1) small farms located close to the market centers, having limited crop area and buying most of their feed; (2) larger farms, situated at a greater distance from the market centers and more adapted to producing their own feed supplies.

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Oats	.6	.2	...	...
Wheat	7.8	3.0	16.2	5.0
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Other pasture	12.2	4.7	15.1	4.6
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TABLE 5—*Average crop yields (1935)*

Crop	16 Huntington farms		20 Charleston farms	
	Total acres	Yield per acre	Total acres	Yield per acre
Corn bushels	237	16.2	353	19.4
Silage tons	53	5.9	129	6.5
Oats bushels	10	30.0	...	...
Wheat bushels	125	18.3	323	12.7
Timothy tons	30	1.5	177	1.6
Red clover tons	11	2.9	79	2.3
Mixed clover and timothy tons	80	1.6	175	1.7
Lespedeza tons	25	1.6	11	2.5
Alfalfa tons	82	2.4	116	1.9
Soybeans tons	79	2.0	249	1.7
Oat hay tons	22	1.2	39	2.0

Explanation of Credits and Items of Cost

Average prices and variations The prices charged for some items of expense are given in Table 6. The price of ready-mixed concentrates did not vary much during the year. Ready-mixed feed with a crude protein content of 16% sold at around $1.65 per cwt. throughout most of the year, rising somewhat in price during the late winter and spring of 1936. So very little hay was purchased that it had no noticeable effect on the average value of the hay fed.

Rules followed in charging costs Grain and hay raised at home were charged to the cows at the prices they could have been sold for at the farm. Purchased feeds were charged at their cost at the farm. Pasture was charged at the prevailing local rates for rented pasturage.

Silage was valued at about one-third the price of timothy hay. Since it is not commonly bought or sold, the most suitable charge to make for silage is not easy to determine. On a total digestible nutrients basis its feeding value is about one-third that of timothy hay. Feeding experiments show its comparative value to be somewhat greater than one-third. However, since silage is raised only to be fed by the grower, who ordinarily can make no other disposition of the crop, many investigators favor charging silage to livestock at the cost of production. While actual cost figures are not available, it is probable that the average cost of producing silage in West Virginia is approximately $5 to $6. Thus the value of $4 used in this study and calculated on the basis of comparative feeding value is probably lower than the cost of production.

TABLE 6—*Average value of some factors in the cost of producing milk in the Huntington and Charleston markets (1935-36)*

Item		Huntington	Charleston
Concentrates	per 100 lb.	$ 1.58	$ 1.62
Hay	per ton	14.59	15.14
Silage	per ton	4.00	4.00
Pasture	per cow per month	1.70	2.26
Labor	per hour	.15	.15

Hired labor was charged at its actual cost. The cost of the operator's labor, and of family labor, was figured from the average rate paid to all hired help, and no allowance was made for the operator's managerial ability.

Depreciation of cows was obtained by substracting the sum of ending inventory plus sales and losses from the sum of beginning inventory plus purchases and value of heifers freshening. Where the ending inventory etc. was the larger figure, the increase was credited as appreciation. Changes in the market price of cows were not allowed to influence the inventory valuation of cows at the end of the year. Building charges include depreciation at 4% of the value in the beginning inventory, interest at 5% of the average inventory value, and current expenses for repairs and maintenance. Equipment charges include depreciation (the difference between the beginning and the ending equipment inventories), interest at 5% on the average inventory value, repairs, and purchases of small items of equipment.

Interest on cows was charged at the rate of 5% of the average inventory value. "Other costs" include actual expenditures for taxes, bedding, veterinary expense, coal, oil, gas, water, and electricity.

Credits The credits other than milk include the value of manure and calves produced and the appreciation or increase in inventory value of cows. The value of manure produced was based on the market value of the fertilizing constituents estimated to be contained in the feed fed. The amounts of nitrogen, phosphorus, and potassium were estimated by the use of average analyses reported by Henry and Morrison.* Calves were valued at $2 when kept to be raised for replacements and at their selling price when sold.

For farms which bottled and retailed their own milk, all labor, equipment, and material costs up to the time the milk was cooled were included in the production cost. On farms which sold their milk to distributing plants, the cost included all expenses up to the time the cans of milk were placed at the roadside to be taken away by the hauler. Hauling costs were not included as a cost of production In calculating returns, the hauling costs were deducted from the price paid by the plants. Thus both costs and returns are f. o. b. the farm.

Cost of Production Per Cow on Huntington Farms

The average cost of keeping a cow a year in the Huntington area was $117.13, the range being from $92.45 to $157.22. The total cost and the items making the totals for each of the herds studied in the Huntington market are given in Table 7.

Production The average production per cow was 5,225 pounds of milk testing 4.14% fat, or an average of 216.5 pounds of fat per cow. In order to eliminate differences in fat test, the average milk pro-

*Henry, W. A., & Morrison, F. B. Feeds and Feeding. Appendix, Table III, 19th edition, 1928.

TABLE 7—*Cost of keeping a cow on farms in the Huntington market (July 1, 1935, to June 30, 1936)*

Farm No.	Lb. 4% milk equivalent per cow	Feed and pasture	Labor		Depreciation of cows	Interest on cows	Building charge	Equipment charge	Supplies	Bull costs	Other costs	Total
			Hours	Cost								
9	6,317	$63.40	245	$36.83	$	$2.77	$22.06	$ 1.87	$4.25	$ 1.00	$4.04	$136.22
6	6,200	87.95	225	33.70	3.58	2.28	14.84	1.62	1.77	6.51	4.97	157.22
5	6,196	67.33	106	15.96	.31	2.08	11.63	1.52	.78	1.47	3.18	104.26
15	6,178	63.61	197	29.52	.67	3.74	7.93	5.51	.97	1.15	2.28	115.38
12	5,827	62.58	86	12.88	...	2.51	19.07	3.32	2.91	1.54	4.97	109.78
3	5,517	65.65	136	20.39	...	2.12	12.72	.36	2.14	1.00	3.74	108.11
13	5,514	50.36	193	28.99	...	1.89	4.72	1.77	1.67	1.23	1.82	92.45
16	5,337	68.94	235	35.19	...	2.10	7.71	2.15	8.55	.66	3.57	128.88
7	5,253	59.62	179	26.81	14.67	2.45	17.03	1.67	8.16	1.07	9.39	140.87
4	5,065	60.13	162	24.26	...	1.60	10 27	.54	8.69	4.57	3.42	113.48
11	4,832	54.20	209	41.77	.33	1.43	22.36	1.13	.79	3.19	9.47	134.67
10	4,825	49.08	138	20.64	.67	1.87	7.29	2.18	1.83	11.10	4.27	99.93
1	4,821	52.26	174	26.06	...	1.84	12.92	.94	1.56	4.56	5.39	105.53
2	4,790	76.36	274	41.03	3.59	1.88	21.59	2.59	1.59	1.93	3.01	155.57
8	4,751	61.42	274	41.14	2.45	2.34	7.90	10.49	1.67	1.79	1.86	131.06
14	4,638	56.16	204	30.65	2.88	2.01	6.49	2.68	1.61	1.78	2.35	106.61
Ave.	5,336	60.53	174	27.04	1.51	2.13	12.49	2.66	2.61	3.74	4.42	117.13

duction was converted to the equivalent amount of 4% milk.* Average production per cow of 4% milk-equivalent was 5,336 pounds. The highest producing herd averaged 6,317 pounds of 4% milk-equivalent per cow, while the lowest herd produced only 4,638 pounds per cow.

Feed cost The cost of feed made up 52% of the total cost of keeping a cow. It averaged $60.53 per cow and ranged from $49.08 to $87.95. The range in costs was due partly to differences in quantities fed because of differences in production, and partly to the kinds and cost of feed used.

Labor The cost of labor averaged $27.04 per cow, or 23% of the total cost. The wages paid hired labor ranged from 15c to 20c per hour. Most of it was at 15c, however, and that rate was used in figuring the value of the work done by the operator and members of his family. The amount of labor per cow ranged from 86 hours to 274 hours, the average being 174. The range of total labor costs was from $12.88 to $41.77. Differences in the number of cows per herd caused much of the variation in the amount of labor per cow. In the Huntington market the average size of herd was 12.26 cows.

Depreciation There was a depreciation in the value of the cows in nine of the herds in the Huntington group. It ranged in amount from 31c to $14.67 and averaged $1.51 per cow for the 16 herds. This rather low figure is due to beginning inventory values that were lower than the prices received for cows sold for dairy purposes. Beginning inventory values were only slightly higher than the prices received for cows sold for beef.

Interest on cows The average value of all cows kept in the herds studied was $42.60. The resulting interest charge was $2.13. The range in interest charges was from $1.43 to $3.74 per cow. There was a tendency for cows in high producing herds to be valued higher than cows in low-producing herds; hence the interest cost per cow tended to be high with high production. The interest cost per cwt. of milk, however, tended to be the same, whether production per cow was high or low.

Building charge The cost of housing averaged $12.49 per cow, being made up of $5.51 for building depreciation, $5.45 for interest on investment, and $1.53 for repairs. The range of building charges was from $4.72 to $22.36. The high costs tended to occur in the smaller herds, but some of the largest herds had above average building costs. The barns and milk houses of some of the herds studied barely met the requirements of the Huntington public-health ordinance. Several dairymen found it advisable to discontinue selling milk during the year because of requirements with which their buildings and equip-

*Using the formula of Gaines and Davidson: (pounds of milk × 0.4) + (pounds of fat × 15) = pounds 4% milk-equivalent. Ill. Agr. Exp. Sta. Bul. 245, p. 594. 1923.

ment did not comply. Any improvements made by dairymen in their buildings would increase the building charge.

Equipment charge The average charge for use of equipment was $2.66 per cow, ranging from 36c to $10.49. The item of equipment that had the greatest variation in cost was the cooling equipment. Where mechanical refrigerators were used, they more than doubled the equipment charge. The items making up the average equipment charge were $1.67 depreciation, 70c interest, and 29c repairs and purchases.

Supplies Cash expenses for supplies ranged from 78c to $8.69 per cow. The average was $2.61, which covered the expenses incurred for filter discs, disinfectant, washing powder, and similar items.

Bull costs The cost of bull service varied with the value of the bulls used, with the care they received, and with the size of herds. The lowest cost per herd was 66c per cow and the highest $11.10. The average cost for all herds was $3.74. Among the herds having the very low costs were those which hired bull service. The standard fee was $1 per cow. With one exception, dairymen who kept bulls were unable to bring their bull costs per cow as low as $1.

"Other costs" The sum of all other items of expense averaged $4.42 per cow. This average was made up of taxes and insurance amounting to $2.13; veterinary expense, 47c; electricity and heat, $1.43; and bedding, 39c. The range of these "other costs" was from $1.82 to $9.47.

Credits and net returns The value of manure produced, figured by the method given on page 8, amounted to $11.91 per cow for all herds, but ranged from $9.34 to $17.97 per cow for different herds. Calves produced had an average value per cow of $1.53. In seven herds the cows increased in value during the year by amounts ranging from 70c to $3.68. The average increase, or appreciation, on the basis of all cows included in the Huntington area was 80c. The total value of all these credits — manure, calves, and appreciation — was $14.24 per cow. This, subtracted from the total cost per cow, $117.13, left the net cost of producing milk, $102.89 per cow. The total value of milk sold and used on the farm was $102.31, so that there was a loss of 58c per cow. Subtracting all costs of keeping a cow, except labor, from the total income, and dividing the remainder by the hours of labor per cow, gives the returns for labor, which was 14c per hour. This return per hour of labor varied from 48c to zero, and some herds failed to earn enough to cover their other expenses, the loss being shown as a minus return per hour of labor. Minus returns as low as 4c were found.

The average production, total and net costs, and returns for each of the herds studied in the Huntington market are shown in Table 8.

TABLE 8—*Amount of milk produced per cow, credits, and returns by herds for milk on farms in the Huntington market (July 1, 1935, to June 30, 1936)*

Farm No.	Production				Total cost	Credits other than milk				Net cost	Returns for milk produced	Profit or loss
	Lb. 4% milk equiv.	Lb. milk	% fat	Lb. fat		Manure	Calves	Appreciation	Total			
9	6,317	6,266	4.05	254.0	$136.22	$11.28	$4.60	$ .70	$16.58	$119.64	$114.30	$ —5.34
6	6,200	5,611	4.89	274.6	157.22	17.97	.69	...	18.66	138.56	95.80	—42.76
5	6,196	5,741	4.53	260.0	104.26	14.12	1.74	...	15.86	88.40	124.48	36.08
15	6,178	6,385	3.78	241.6	115.38	15.85	.96	...	16.81	98.57	116.97	18.40
12	5,827	6,356	3.46	219.0	109.78	10.21	1.88	2.49	14.58	96.20	107.01	11.81
3	5,517	5,388	4.16	224.0	108.11	12.54	..	1.29	13.83	94.28	135.89	41.61
13	5,514	5 795	3.68	213.1	92.46	11.96	...	.90	12.86	79.60	109.54	29.94
16	5,337	5,277	4.08	215.1	128.86	17.47	...	2.67	20.14	108.72	63.99	—44.73
7	5,253	5,670	3.51	199.0	140.88	11.13	1.19	...	12.32	128.56	96.27	—32.23
4	5,065	4,576	4.71	215.7	113.48	12.95	7.95	2.63	23.53	89.95	86.59	—3.36
11	4,832	5,028	3.74	188.0	134.67	9.34	1.29	...	10.63	124.04	79.05	—44.99
10	4,825	4,265	4.88	207.9	99.93	9.46	.73	...	10.19	89.74	114.00	24.24
1	4,821	4,766	4.08	194.2	105.53	10.66	4.53	3.68	18.87	86.66	69.79	—16.87
2	4,790	4,711	4.11	193.7	155.57	14.22	1.37	...	15.59	139.98	95.12	—44.86
8	4,751	4,804	3.93	188.6	131.06	10.64	1.90	...	12.54	118.52	98.49	—20.03
14	4,638	4,187	4.72	197.5	106.61	10.15	.66	...	10.81	95.80	93.38	—2.42
Ave.	5,336	5,225	4.14	216.5	117.13	11.91	1.53	.80	14.24	102.89	102.31	—.58

Cost of Production Per Cow on Charleston Farms

The average cost of keeping a cow for a year on farms studied in the Charleston market was $130.20. The averages of the various cost items are shown for each of the herds in Table 9.

Production The average cow in the Charleston group produced 5,811 pounds of milk which tested 3.91% and contained 227.2 pounds of butterfat. This is equivalent to 5,734 pounds of milk containing 4% butterfat. The highest average production of any herd was 7,426 pounds of 4% milk-equivalent per cow, the remaining herds ranging from 4,716 to 6,732 pounds per cow.

Feed cost The cost of feed amounted to $75.54 per cow. Depending largely on production per cow, the extremes in feed costs were $52.35 and $105.92. High feed costs were also due in some cases to intensive grain feeding and in others to the need for buying considerable amounts of feed.

Labor The amount of time spent in these herds averaged 159 hours per cow, with extremes of 88 to 236 hours. The average size of herd was 22.24 cows. As in the Huntington herds, the labor cost, except for hired labor, was figured at an average rate of 15c per hour. At that rate, the average labor cost per cow was $24.56, ranging from $13.16 to $39.77.

Depreciation of cows Because of inventory values that were low in relation to selling prices, and an unusually high turnover in many herds during the year, there were only seven herds in which there was a net depreciation of cows. It ranged from 33c to $8.06 per cow, but when averaged over all cows amounted to $1.62.

Interest on cows Interest at 5% of the investment in cows amounted to $2.49 per cow, which represents an investment of $49.80. The range of interest charges was from $1.87 to $3.35. Apparently some factors other than producing ability governed the evaluation of cows on these farms, for there was no apparent relation between average production per cow and interest charge per cow.

Building charge The average charge for use of buildings was $13.49 per cow. It consisted of building depreciation amounting to $6.26, interest on building investment amounting to $6.61, and repairs averaging 62c per cow. The range in building costs was from $2.78 to $41.44. Differences in these costs were caused by the type of construction, the age of the barn, and the number of cows kept.

Equipment charge Charges for the use of equipment averaged $3.12 per cow, being made up of $1.68 depreciation, 96c interest, and 48c repairs and purchases. The range of equipment costs was from 13c to $16.63, depending on how completely the dairy was equipped and on the size of herd. In general the Charleston area farms were

TABLE 9—*Cost of keeping a cow by herds on farms in the Charleston market (Aug. 1, 1935, to July 31, 1936)*

Farm No.	Lb. 4% milk equivalent per cow	Feed and pasture	Labor		Depreciation of cows	Interest on cows	Building charge	Equipment charge	Supplies	Bull costs	Other costs	Total
			Hours	Cost								
18	7,426	$ 86.65	221	$39.77	$5.42	$1.87	$ 4.34	$ 1.58	$1.81	$ 1.88	$ 2.52	$145.84
6	6,732	72.64	123	18.49	.33	2.29	13.52	6.03	.53	2.93	5.95	122.71
17	6,368	78.74	182	27.34	...	2.10	5.37	.23	1.75	3.48	2.05	121.06
4	6,303	68.75	187	28.10	...	3.06	7.95	1.51	.78	1.54	1.56	113.25
13	6,211	105.92	168	25.23	...	2.77	11.26	16.63	3.00	12.75	12.50	190.08
9	5,969	70.21	236	35.45	...	2.34	13.42	6.61	.71	1.67	5.02	135.43
11	5,948	96.56	133	19.96	4.33	3.35	19.51	5.74	.88	1.05	10.70	162.08
7	5,928	75.56	172	25.85	1.24	2.00	39.03	.13	1.09	3.43	6.35	154.68
1	5,912	71.40	145	21.81	...	2.20	18.59	1.98	2.14	4.47	6.32	128.91
19	5,692	93.45	116	17.37	...	2.42	7.45	4.52	.67	3.01	3.38	132.27
14	5,673	82.40	119	22.07	...	3.30	15.32	3.65	1.34	11.33	9.84	149.25
5	5,516	63.10	157	23.52	...	2.20	4.78	2.62	.82	2.06	2 50	101.60
8	5,381	65.29	212	31.76	8.06	2.27	5.99	.78	7.30	1.14	5.40	127.99
20	5,375	65.51	180	27.07	5.00	2.65	41.44	.94	.62	4.43	2.80	150.46
10	4,991	78.84	136	20.48	3.76	2.37	24.69	2.06	4.18	3.38	6.21	145.97
3	4,910	71.97	116	17.38	...	2.07	16.82	.94	.54	2.95	4.38	117.05
12	4,890	63.51	169	25.34	...	3.22	9.80	1.49	2.18	.94	3.14	109.62
16	4,868	64.97	113	16.99	...	2.38	2.78	.71	.58	4.17	1.21	93.79
2	4,865	52.35	140	20.93	2.24	2.36	4.67	1.45	.97	2.69	6.00	93.66
15	4,716	73.01	88	13.16	...	2.23	5.92	1.50	.25	3.13	5.56	104.76
Ave.	5,734	75.54	159	24.56	1.62	2.49	13.49	3.12	1.28	2.95	5.15	130.20

more fully equipped than were Huntington area farms, and would have had considerably higher equipment costs per cow if there had not been a larger number of cows per farm.

Supplies The average cost of supplies was $1.28 per cow, ranging from 25c to $7.30.

Bull costs Because of the larger size of herds, bull costs were lower in Charleston than in Huntington herds. Bull costs averaged $2.95 per cow, the extremes of cost being 94c and $12.75.

"Other costs" "Other costs" including expenses for bedding, veterinary, light, heat in the milk house, power, taxes, etc. amounted to $5.15 per cow. Various items were: bedding, 53c; heat, light, and power, $2.28; taxes, $2.08; veterinary expense, 26c. The range of these other costs was from $1.21 to $12.50.

Credits The value of manure produced per cow was $13.70. It was higher than in the Huntington market because of the intensive grain feeding along with the high percentage of legume hays fed. Value of calves averaged $1.70 per cow. The net appreciation occurring in 12 herds averaged $1.63 per cow for all cows, and brought the total miscellaneous credits to $17.03. The range was from $12.17 to $25.68.

Subtracting miscellaneous returns of $17.03 from total costs of keeping a cow, $130.20, leaves the net cost of the milk produced, $113.17. The total value of all milk sold and used on the farm was $143.23, leaving a net income of $30.06 per cow. Subtracting all costs of keeping a cow, except labor, from the total income, and dividing the remainder by the hours of labor per cow gives the return for labor, which was 34c per hour. The return per hour of labor varied in different herds from 4c to 62c.

The average production, total and net costs, and returns for each of the herds studied in the Charleston market are shown in Table 10.

Cost of Production Per Hundredweight of Milk

Costs per cwt. of milk show the same relationships between the items of expense as do costs per cow. However, since costs per cwt. are more easily compared with the price of milk, they may more readily show significant variations in costs of production. For that reason Tables 11 and 12 are presented. They show the costs and returns per cwt. of 4% milk-equivalent for all herds in this study.

Effect of level of production The herd data in the tables are arranged in order of production, with highest producing herds at the top. This makes it possible to see the extent of the relation between production and costs per cwt. of milk. In the Huntington market the relation was not very pronounced. However, it was found, for example, that the herds having the highest feed expenses per cwt. of milk produced were among the low producing herds, while herds

TABLE 10—*Milk produced per cow, credits, and returns by herds for milk on farms in the Charleston market (Aug. 1, 1935, to July 31, 1936)*

Farm No.	Production				Total cost	Credits other than milk				Net cost	Returns for milk produced	Profit or loss
	Lb. 4% milk equiv.	Lb. milk	% fat	Lb. fat		Manure	Calves	Appre-ciation	Total			
18	7,426	7,685	3.78	290.1	$145.84	$15.96	$ .91	$ ...	$16.87	$128.97	$212.96	$83.99
6	6,732	6,456	4.32	276.6	122.71	10.74	1.43	...	12.17	110.54	168.66	58.12
17	6,368	5,794	4.66	270.1	121.06	17.31	.92	3.43	21.66	99.40	159.19	59.79
4	6,303	6,036	4.29	259.2	113.25	11.28	1.93	.40	13.61	99.64	147.89	48.25
13	6,211	6,282	3.92	246.6	190.08	20.95	...	2.20	23.15	166.93	147.58	—19.35
9	5,969	6,016	3.95	237.5	135.43	11.27	1.01	4.58	16.86	118.57	153.27	34.70
11	5,948	6,254	3.67	229.8	162.07	19.34	2.07	...	21.41	140.66	171.05	30.39
7	5,928	5,795	4.15	241.2	154.68	16.22	.36	...	16.58	138.10	133.71	—4.39
1	5,912	5,989	3.91	234.4	128.91	13.99	...	8.21	22.20	106.71	120.37	13.66
19	5,692	5,366	4.40	236.4	132.27	16.30	1.23	1.12	18.65	113.62	147.10	33.48
14	5,673	5,639	4.04	227.8	149.25	18.97	6.00	.71	25.68	123.57	134.98	11.41
5	5,516	5,252	4.33	227.7	101.60	10.91	3.89	.34	15.14	86.46	131.19	44.73
8	5,281	5,152	4.30	221.4	127.99	11.78	1.09	...	12.87	115.12	125.58	10.46
20	5,375	5,863	3.45	202.1	150.46	11.22	1.29	...	12.51	137.95	118.41	—19.54
10	4,991	5,031	3.95	198.6	145.97	16.10	.43	...	16.53	129.44	117.08	—12.36
3	4,910	5,494	3.29	180.9	117.05	13.15	.94	.47	14.56	102.49	125.24	22.75
12	4,890	5,073	3.76	190.7	109.62	12.25	2.04	2.85	17.14	92.48	120.97	28.49
16	4,868	4,743	4.18	198.0	93.79	11.88	1.11	2.40	15.39	78.40	115.69	37.29
2	4,865	5,387	3 35	180.7	93.66	8.94	6.72	...	15.66	78.01	133.77	55.76
15	4,716	4,993	3.63	181.3	104.76	9.78	1.17	4.31	15.26	89.50	100.42	10.92
Ave.	5,734	5,811	3.91	227.2	130.20	13.70	1.70	1.63	17.03	113.17	143.23	30.06

TABLE 11—*Cost of producing 100 pounds of milk by herds on farms studied in the Huntington market (for one year ending June 30, 1936)*

Farm No.	Lb. of 4% milk produced per cow	Cost per 100 pounds of 4% milk														
		Feed and pasture	Labor		Depreciation of cows	Int. on cows	Building charges	Equipment charge	Supplies	Bull costs	Other costs	Total	Credits other than milk	Net costs	Value of milk sold and used on farm	Returns per hour of labor
			Hrs.	Cost												
9	6,317	$1.01	3.9	$.58	..	$.04	$.35	$.03	$.07	$.02	$.06	$2.16	$.26	$1.90	$1.81	$.12
6	6,200	1.38	3.6	.53	.06	.04	.24	.03	.03	10	.08	2.49	.30	2.19	1.52	—.04
5	6,196	1.09	1.7	.26	.01	.03	.19	.02	.01	.02	.05	1.68	.26	1.42	2.01	.48
15	6,178	1.03	3.2	.48	.01	.04	.13	.09	.02	.02	.03	1.85	.27	1.58	1.89	.24
12	5,827	1.07	1.5	.22	..	.04	.33	.06	.05	.03	.08	1.88	.25	1.63	1.84	.28
3	5,517	1.18	2.5	.37	..	.04	.23	.01	.04	.02	.07	1.96	.25	1.71	2.46	.46
13	5,514	.91	3.5	.53	..	.03	.09	.02	.03	.02	.03	1.66	.23	1.43	1.99	.30
16	5,337	1.29	4.4	.66	..	.04	.14	.04	.16	.01	.07	2.41	.38	2.03	1.20	.04
7	5,253	1.13	3.4	.51	.28	.05	.32	.03	.16	.02	.18	2.68	.23	2.45	1.83	—.03
4	5,065	1.19	3.2	.48	..	.03	.20	.01	.18	.09	.06	2.24	.46	1.78	1.64	.13
11	4,832	1.12	4.3	.86	.01	.03	.46	.02	.02	.07	.20	2.79	.22	2.57	1.64	—.02
10	4,825	1.01	2.9	.43	.01	.04	.15	.07	.04	.23	.09	2.07	.21	1.86	2.36	.32
1	4,821	1.08	3.6	.54	..	.04	.27	.02	.03	.10	.11	2.19	.39	1.80	1.45	.05
2	4,790	1.59	5.7	.86	.12	.04	.45	.05	.04	.04	.06	3.25	.33	2.92	1.99	—.01
8	4,751	1.30	5.8	.87	.05	.04	.17	.22	.03	.04	.04	2.76	.26	2.50	2.07	.07
14	4,638	1.21	4.4	.66	.06	.04	.14	.06	.04	04	.05	2.30	.23	2.07	2.01	.14
Ave.	5,336	1.14	3.3	.51	.03	.04	.23	.05	.05	.07	.08	2.20	.26	1.94	1.92	.14

TABLE 12—*Cost of producing 100 pounds of milk by herds on farms studied in the Charleston market (for one year ending July 31, 1936)*

Farm No.	Lb. of 4% milk produced per cow	Cost per 100 pounds of 4% milk														
		Feed and pasture	Labor		Depreciation of cows	Int. on cows	Building charges	Equipment charge	Supplies	Bull costs	Other costs	Total	Credits other than milk	Net costs	Value of milk sold and used on farm	Returns per hour of labor
			Hrs.	Cost												
18	7,426	$1.17	3.0	$.54	$.07	$ 03	$.06	$.02	$.02	$.02	$.03	$1.96	$.23	$1.73	$2.87	$.58
6	6,732	1.09	1.8	.28	..	.03	.20	.09	.01	.04	.09	1.83	.18	1.65	2.53	.62
17	6,368	1.23	2.9	.43	..	.03	.08	..*	.03	.06	.03	1.89	.34	1.55	2.50	.47
4	6,303	1.10	3.9	.45	..	.05	.13	.02	.01	.02	.02	1.80	.22	1.58	2.40	.40
13	6,211	1.71	4.1	.40	..	.05	.28	.27	.05	.20	.20	3.06	.38	2.68	2.37	.04
9	5,969	1.19	4.0	.59	..	.04	.22	.11	.01	.03	.08	2.27	.28	1.99	2.57	.30
11	5,942	1.62	3.5	.34	.07	.06	.33	.10	.01	.02	.18	2.73	.36	2.37	2.88	.38
7	5,928	1.27	2.9	.44	.02	.03	.66	..*	.02	.06	.11	2.61	.28	2.33	2.26	.13
1	5,912	1.20	2.5	.37	..	.04	.31	.03	.04	.08	.11	2.18	.38	1.80	2.04	.24
19	5,692	1.64	2.0	.31	..	.04	.13	.08	.01	.05	.06	2.32	.33	1.99	2.58	.44
14	5,673	1.46	2.1	.39	..	.06	.27	.06	.02	.20	.17	2.63	.45	2.18	2.38	.28
5	5,516	1.14	2.8	.53	..	.04	.09	.05	.02	.04	.05	1.96	.27	1.69	2.38	.44
8	5,381	1.22	4.0	.59	.15	.04	.11	.01	.14	.02	.10	2.38	.24	2.14	2.33	.19
20	5,375	1.22	3.4	.50	.09	.06	.77	.02	.01	.08	.04	2.79	.23	2.56	2.20	.04
10	4,991	1.57	2.7	.41	.08	.05	.50	.04	.08	.07	.12	2.92	.33	2.59	2.35	.06
3	4,910	1.47	2.4	.35	..	.04	.34	.02	.01	.06	.09	2.38	.30	2.08	2.55	.35
12	4,890	1.30	3.4	.52	..	.07	.20	.03	.04	.02	.06	2.24	.35	1.89	2.47	.31
16	4,868	1.23	2.3	.34	..	.05	.06	.02	.01	.09	.03	1.93	.32	1.61	2.38	.48
2	4,865	1.07	2.9	.43	.05	.05	.10	.03	.02	.06	.12	1.93	.32	1.61	2.75	.54
15	4,716	1.53	1.9	.28	..	.05	.13	.03	.01	.07	.12	2.22	.32	1.90	2.13	.27
Ave.	5,734	1.32	2.8	.43	.03	.04	.24	.05	.02	.05	.09	2.27	.30	1.97	2.50	.34

*Less than one cent.

having the lowest feed expenses per cwt. of milk were high-producing herds.

In the Charleston group another factor obscures the usual relation between costs and level of production. Several of the higher producing herds in this market obtained that production with intensive feeding and care. As a result, some herds above average in milk production had higher costs per cwt. of milk as well.

Intensive feeding (such as all the roughage that will be eaten, plus one pound of grain for each 2½ pounds of milk) may be advisable when the price of milk is considerably above the cost of production, or when it is necessary temporarily to prevent the loss of a market. When production costs must be kept low, however, both heavy feeding and underfeeding are uneconomical.

Net costs and returns The net cost of producing milk in the Huntington group ranged from $1.42 to $2.92 per cwt. of 4% milk. The average was $1.94. The average price received was $1.92.

In the Charleston market the average net cost per cwt. was found to be $1.97. The range in costs was from $1.55 to $2.68. Returns averaged $2.50 per cwt.

Relation between feed, labor, and total costs Feed cost represented 52% of the total cost in the Huntington market and 58% of the total in the Charleston market. Labor made up 23% of the cost in the Huntington market and 19% in the Charleston market. The lower ratio of feed to total cost in the Huntington market area than in the Charleston market area was due to lower production per cow obtained by less intensive feeding in the Huntington area. The higher ratio of labor to total costs in the Huntington area is due to the smaller size of herds in the Huntington group than in the Charleston group, resulting in a larger amount of labor per cow.

Amounts of Feed and Labor Used In Producing Milk

Changes in the cost of producing milk from year to year are due mostly to changes in the price of feed and labor. Those price changes, particularly for feeds, have been wide during recent years and tend to render cost studies reported in terms of dollars obsolete even before the results are published. The following physical data are given so that, whenever it is desirable, most of the money costs found in this study may be adjusted to current conditions. It is necessary to assume that the kinds and quantities of feeds fed will not change with changing price, and that production will not be affected. That assumption is not strictly true, but it is not probable that changes in feeding or management will be as severe as price changes.

Amounts and kinds of concentrates fed The principal grains fed were corn-and-cob meal and ready-mixed feeds containing 16 or 24% of protein. Grain formulas containing all the kinds of grain used in each market and showing the relative amounts of each kind are given in Table 13.

TABLE 13—*Relative amounts of various kinds of grain fed*

Item	Lb. in 100 lb. of grain fed	
	Huntington	Charleston
Corn	28	20
Oats	3	..
Wheat	6	9
Mixed feeds: 16% protein	29	14
20% protein	4	2
22% protein	..	11
24% protein	22	37
Cottonseed meal	4	1
Other feeds	4	6
Total	100	100

Table 14 exemplifies the method of determining the average price of grain for the Charleston market. In column 3 are set the prices per cwt. of the feeds named in column 1. Figures in column 3 are multiplied by the figures in column 2, and the results set down in column 4. Dividing the sum of column 4 by 100, the result is the price per cwt. of the average grain mixture. To find the average price of grain in the Huntington market, substitute in column 2 the pounds of each kind of grain per 1000 pounds of grain fed in the Huntington market.

The total amount of grain fed per cow in the Huntington area was 1,768 pounds per year. With an average production of 5,336 pounds of 4% milk, the rate of feeding grain was one pound for each 3.1 pounds of milk. In the Charleston area 2,128 pounds of grain were fed in producing 5,734 pounds of 4% milk, making the rate of feeding one pound of grain for each 2.7 pounds of milk.

Amounts and kinds of roughages fed The amount of hay fed in the Huntington market averaged 2,228 pounds per cow. Alfalfa, soybeans, lespedeza, and clover made up 68% of this amount, the remainder being timothy and mixed hay. Silage was fed to the

TABLE 14—*Method of calculating average cost of grain*

Column 1	Column 2	Column 3	Column 4
Ingredient	Lb. of ingredient per cwt. of mixture	Price of ingredient per cwt.	Product of Col. 2 × Col. 3
Corn-and cob meal	20	$1.80	$36.00
Wheat	9	2.00	18.00
Mixed feeds: 16% protein	14	1.75	24.50
20% protein	2	2.15	4.30
22% protein	11	2.15	23.65
24% protein	37	2.20	81.40
Cottonseed meal	1	2.30	2.30
Other feeds*	6	1.75	10.50
	Sum of Column 4		200.65
Ave. cost of grain per cwt. (Sum of Col. 4 ÷ 100)			2.01

*Use price of 16% ready-mixed feed.

amount of 1,669 pounds per cow. Stover, fed in a few herds, averaged 207 pounds per cow.

In the Charleston area hay was fed at the rate of 2,536 pounds per cow. It was 89% legume. The average cow received also 1,325 pounds of silage and 39 pounds of stover.

Labor The average amount of labor required per cow in the Huntington market was 174 hours, and in the Charleston market, 159 hours.

Computing costs of milk production at changing price levels The foregoing quantities of feed and labor may be used as a basis for computing costs of producing milk when price levels differ from what they were during 1935-36. Since changing price levels do not greatly affect interest, building, and equipment charges, it is probable that costs other than feed and labor will remain near the 1935-36 level for some time. Adding those costs to an estimate of current feed and labor costs should give a usable estimate of the cost of producing milk. The total cost of items other than feed and labor amounted to $29.57 per cow in the Huntington market, or 55c per cwt. of 4% milk, and to $30.12 per cow in the Charleston market, or 53c per cwt. of 4% milk. To arrive at the net cost of milk, miscellaneous credits should be deducted from the total cost of keeping a cow. These averaged $14.24 per cow, or 26c per cwt. of milk, in the Huntington market, and $17.03 per cow, or 30c per cwt. of milk, in the Charleston market.

TABLE 15—*Amounts of feed and labor used in producing milk in the Huntington and Charleston markets (1935-36)*

Item	Per cow		Per 100 lb. milk	
	Huntington	Charleston	Huntington	Charleston
Average production (lb. milk)	5,336	5,734	..	..
Concentrates (lb.)	1,768	2,128	33	37
Hay (lb.)	2,228	2,536	42	44
Silage (lb.)	1,669	1,325	31	23
Other roughage (lb.)	207	39	4	6
Pasture days	218	217	4.1	3.8
Man labor (hrs.)	174	159	3.3	2.8
Value of all other items of expense	$29.57	$30.12	55c	53c
Value of miscellaneous credits	$14.24	$17.03	26c	30c
Percentage of total cost contributed by feed and labor	....	....	74.6	76.9

Table 15 shows the amounts of feed and labor used, and the total cost of all other items of expense for both markets.

As an example of the way in which these cost figures may be revised, the Charleston costs are adjusted in Table 16, using feed prices for the fall of 1936. In this table the quantities of feed and labor, in column 2, are multiplied by their prevailing prices, given in column 3. The product, set down in column 4, is the cost per cow.

TABLE 16—*Method of adjusting cost of production figures for price changes*

Column 1	Column 2	Column 3	Column 4
Item	Quantity	Price	Cost
Pounds milk produced	5,734	.....	.....
Concentrates (lb.)	2,128	$ 2.01 per cwt	$ 42.77
Hay (lb.)	2,536	20.00 per T.	25.36
Silage (lb.)	1,325	5.00 per T.	3.31
Stover (lb.)	39	5.00 per T.	.98
Pasture (days)	217	.075 per day	16.28
Labor (hours)	159	.15 per hr.	23.85
Total of all other items of cost	....	.....	30.12
Total cost	....	.....	142.67
Value of miscellaneous credits	....	.....	17.03
Net cost of milk	....	.....	125.64
Cost of milk per cwt.	....	.....	2.19

COMPARISON OF HERDS OF VARYING EFFICIENCY

In order to determine what factors were most responsible for low costs of production, the nine herds having the lowest net costs per cwt. (as shown in Tables 11 and 12) were averaged together. The nine highest cost herds were also averaged together, and the resulting averages are shown in Table 17.

There was very little difference between groups as to size of the herds or in the number of days each cow was in milk.

There was a difference in production per cow of 826 pounds of 4% milk-equivalent, the low-cost herds producing 6,277 pounds while the high-cost herds produced only 5,451 pounds. This difference may be considered to be due to differences in the producing ability of the cows, for the cows in the high-cost herds were fed more grain and roughage than those in the low-cost herds. High cost cows received 2,278 pounds

TABLE 17—*Comparison of the nine low-cost and the nine high-cost herds in the Huntington and Charleston markets (1935-36)*

Item	Per cow		Per 100 lb. of 4% milk	
	Nine low-cost herds	Nine high-cost herds	Nine low-cost herds	Nine high-cost herds
Average no. of cows per herd	18.79	16.80	....	....
Days in milk	296	300	....	....
Pounds of 4% milk	6,277	5,451	....	....
Pounds of grain fed	2,148	2,278	32	42
Percent protein in grain	14.3	18.9	....	....
Pounds of hay	2,436	3,054	39	56
Pounds of silage	1,658	562	26	10
Pounds of other roughage	87	60	1	1
Days pasture	214	206	3.4	3.7
Hours of man labor	162	149	2.5	2.7
Costs:				
Feed and pasture	$ 69.20	$ 79.32	$1.10	$1.46
Labor	26.56	26.62	.42	.49
Remaining costs	20.93	46.27	.33	.85
(Bldg. costs)	(8.69)	(21.77)	(.14)	(.40)
Total cost	116.69	152.21	1.85	2.80
Credits other than milk	15.52	17.56	.25	.32
Net cost	101.17	134.65	1.60	2.48
Value of milk sold and used on farm	150.94	130.39	2.40	2.39
Returns per hour of labor	.47	.15	....	....

of grain, as compared with 2,148 pounds for the low-cost cows. The rates of grain feeding were one pound of grain to 2.4 pounds of milk in the high-cost herds, and one pound of grain to 3.1 pounds of milk in low-cost herds. There was a further difference in the grain, since the grain fed to high-cost cows contained 18.9% total crude protein, while grain fed to the low-cost cows averaged 14.3% protein. In both groups the hay fed was practically all legume: alfalfa, soybeans, or clover.

The roughage fed in high-cost herds consisted of 3,054 pounds of hay, 562 pounds of corn silage, and 60 pounds of stover. In the low-cost herds the average cow received 2,436 pounds of hay, 1,658 pounds of silage, and 87 pounds of stover. The amount of pasture per cow averaged 214 days in low-cost and 206 days in high-cost herds.

High-cost herds required only 149 hours of man labor per cow, while low-cost herds required 163 hours. This may be taken to mean either that cows in high-cost herds had less care or that because of better buildings and equipment the same amount of care could be given with less work. The cost figures show that high-cost herds had greater expenses for buildings, which indicates more conveniences.

The cost of feed was $10 per cow higher in high-cost herds than in low-cost herds. This, along with lower production, made feed costs 36c more per cwt. of milk in high-cost herds than in low-cost herds.

Because of a difference in the rates paid to hired help, the cost of labor in both groups was about the same, despite the larger amount of labor used in low-cost herds.

By far the greatest difference between high and low-cost herds in these markets was in costs other than feed and labor. They amounted to $46.27 per cow in high-cost herds and to $20.93 per cow in low-cost herds. The difference was consistent among all items included. The costs other than feed and labor, on the cwt. basis, were 52c higher in the high-cost than in the low-cost herds.

Normally it is expected that higher building, bull, supply, and equipment costs will be reflected in more efficient production. However, it is apparent from these figures that such expenditures do not guarantee efficient production, and that misfortune or improper application of the larger expenditure may result only in greater inefficiency. In spite of high costs a production level no higher than that of the best herds found in the study would have enabled the high-cost herds to produce milk at a profit.

The net cost per cow was $101.17 per cow, or $1.60 per cwt. of milk-equivalent in low-cost herds and $134.65 per cow or $2.48 per cwt. in high-cost herds. The price received being $2.40 per cwt. in low-cost herds and $2.39 in high-cost herds, the returns per hour of labor were 47c and 15c respectively.

Influence of Size of Herd on Costs

While it was shown that both high and low costs of production were found in herds averaging medium in size, it is of interest to compare the average costs of all medium-size herds with the average costs of small herds and of large herds.

Fifteen herds had from 5 to 13 cows and were grouped as small herds. There were 15 herds of medium size having 14 to 21 cows each, and there were six large herds having from 27 to 54 cows each.

The differences between these three groups of herds were not consistently due to differences in size. Much variation probably is due to the large number of Huntington herds in the small-herd group, and to the predominance of Charleston herds in the medium and large-herd groups. The data are given in Table 18.

Comparison of the production in different groups shows some factors that are independent of herd size. There was no definite trend in production per cow from one herd-size group to another. The medium group, producing 5,461 pounds per cow, averaged 34 pounds per cow less than the small-herd group and 403 pounds less than the large-herd group. These production averages were made on nearly identical quantities of feed. Cows in small herds received the most grain, 2,100 pounds, which was 122 pounds more than was fed to the heavier producing cows of the large herds. By converting silage weights to an equivalent amount of dry roughage, at the rate of three pounds of silage to one pound of hay, it is shown that cows in small herds received 3,153 pounds of dry roughage; in medium herds, 2,977; and in large herds, 3,128 pounds of dry roughage per cow. Thus the differences in concentrates and roughage feeding would account for only small differences in production. The number of days on pasture did not differ greatly between groups. Cows in small herds received 222 days of pasture per cow, in medium herds they received 223 days, while in large herds they received 206 days per cow. Since the differences in amounts of feeds fed do not coincide with the differences in production between groups, the ex-

TABLE 18—*Comparison of the cost of producing milk in small, medium, and large herds in the Huntington and Charleston markets (1935-36)*

Item	Per cow			Per 100 lb. of 4% milk		
	Small herds[1]	Medium herds[2]	Large herds[3]	Small herds	Medium herds	Large herds
Ave. no. of cows per herd	9.57	17.92	38.08	....	....	....
Days in milk	298	297	304	....	....	....
Pounds 4% milk	5496	5461	5864	....	....	....
Pounds of grain	2100	2056	1978	38	37	31
Pounds of hay	2298	2406	2544	42	44	40
Pounds of silage	1907	1578	964	35	28	15
Pounds of other roughage	212	45	64	4	1	1
Days pasture	222	223	206	4	3.4	3.5
Hours of man labor	193	143	170	2.6	2.8	2.6
Costs:						
Feed and pasture	$ 66.60	$ 69.51	$ 75.34	$1.21	$1.28	$1.28
Labor	29.05	22.51	26.25	.53	.41	.45
Remaining costs	29.41	31.36	28.65	.54	.57	.49
Total	125.06	123.38	130.24	2.28	2.26	2.22
Credits other than milk	16.00	16.22	16.24	.29	.30	.28
Net cost	109.06	107.16	114.00	1.99	1.96	1.94
Value of milk sold and used on farm	107.87	127.20	149.12	1.96	2.33	2.54
Returns per hour of labor	....	....	....	.14	.30	.36

[1]5 to 13 cows.
[2]14 to 21 cows.
[3]27 to 54 cows.

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Days in milk	298	297	304	....	....	....
Pounds 4% milk	5496	5461	5864	....	....	....
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Pounds of silage	1907	1578	964	35	28	15
Pounds of other roughage	219	45	64	4	1	1
Days pasture	222	223	206	4	3.4	3.5
Hours of man labor	193	143	170	2.6	2.8	2.6
Costs:						
Feed and pasture	$ 66.60	$ 69.51	$ 75.34	$1.21	$1.28	$1.28
Labor	29.05	22.51	26.25	.53	.41	.45
Remaining costs	29.41	31.36	28.65	.54	.57	.49
Total	125.06	123.38	130.24	2.28	2.26	2.22
Credits other than milk	16.00	16.22	16.24	.29	.30	.28
Net cost	109.06	107.16	114.00	1.99	1.96	1.94
Value of milk sold and used on farm	107.87	127.20	149.12	1.96	2.33	2.54
Returns per hour of labor	....	....	....	.14	.30	.36

[1] 5 to 13 cows.
[2] 14 to 21 cows.
[3] 27 to 54 cows.

planation must be found elsewhere. The most probable explanation is that cows in the large herds had the greatest inherited producing ability.

Feed costs ranged from $66.60 per cow in small herds to $69.51 in medium and $75.34 in large herds. The higher cost of feed per cow in large herds, in spite of the feeding of smaller amounts, indicates that a higher quality of feed may have been used. This in turn may be a partial explanation of the higher production per cow.

The amount of labor used per cow averaged highest in the small herds and least in the medium herds. The cost of labor corresponded to the amounts used, averaging $29.05, $22.51, and $26.25, respectively, for small, medium, and large herds.

After noting the wide difference in the remaining other costs between low and high-cost herds, one finds the differences in costs between different sizes of herds insignificant. At first thought it might be expected that the distribution of necessary overhead expenses over a smaller number of animals would result in higher costs per cow for small herds, decreasing as the size of the herd increased. However, this tendency was counteracted by the building of more expensive barns and by use of a wider variety of equipment in the larger herds. The result was that costs other than feed and labor averaged $29.41 per cow in small herds, $31.26 in medium herds, and $26.65 in large herds.

The net costs per cow were $109.06, $107.16, and $114.00, respectively, for small, medium, and large herds. Because of the higher production per cow, the large herds had the lowest cost per cwt. of milk, $1.94. In medium herds the cost per cwt. was $1.96 and in small herds, $1.99. The difference between small and medium herds was mostly the difference between the Huntington and the Charleston market areas. Both the medium and the large herd groups consisted mostly of Charleston producers, and the difference in the value of milk sold depended on the amounts of base and surplus milk that was sold.

The returns per hour of labor varied between groups, but the difference was mostly because of the varying prices received rather than the varying costs of production. Small herds had a labor return of 14c per hour, medium herds had 30c. and large herds had 36c per hour of labor. These data are given in Table 18.

Costs of Bull Service

The average costs of bull service on some of the farms in both areas are given in Table 19. Huntington herds had lower average costs per herd, mainly because several of them did not keep bulls. The service fees paid were considerably less than the per-cow cost of keeping a bull. Despite the low costs per herd, however, Huntington herds had high costs per cow because of the small number of cows per herd (12.26 cow years). Charleston herds had higher average bull costs per herd but lower costs per cow because of their larger number of cows per herd (22.24 cow years).

The net cost of bull service in 15 Huntington herds was $57.63 per herd, or $4.59 per cow. In 17 Charleston herds the net cost per herd was $73.46, and the net cost per cow was $3.30.

TABLE 19—*Average bull and breeding costs in 15 Huntington and 17 Charleston herds*

Item	Huntington	Charleston
Concentrates	$ 4.34	$19.44
Hay	11.82	22.50
Silage	2.10	.96
Other roughage	....	.35
Pasture	8.40	19.70
Total feed	26.66	62.95
Labor	2.27	4.65
Depreciation	15.33	7.06
Taxes	.43	.33
Interest	4.25	3.30
Building charge	12.49	13.49
Breeding fees paid out	5.00	1.56
Total costs	66.43	93.34
Appreciation	2.73	3.53
Breeding fees received	....	4.41
Manure	6.07	11.94
Total credits	8.80	19.88
Net cost per herd	57.63	73.46
Average cost per cow	4.59	3.30

Average production per cow, amounts of feed and labor used per cwt. of milk, and net cost per cwt. are shown in Table 20 for four market areas in the State. The net cost per cwt. for the Huntington and Charleston markets has been adjusted to the 1934-35 level of feed prices. Production in Morgantown and Charleston herds was at a similar level, though it was obtained in Charleston by the heaviest grain feeding practiced in any of the four markets and in Morgantown by the heaviest roughage and lightest grain feeding.

The percentage of total cost contributed by feed and labor varies widely between markets due, first, to the kinds of feed used; secondly, to the amount of costs in addition to feed and labor; and thirdly, to the intensity of feeding and care that was practiced.

TABLE 20—*Production per cow, amounts of feed and labor used, and cost of milk production in four markets*

Item	Huntington 1935-36	Charleston 1935-36	Morgantown 1934-35	Fairmont 1934-35
Pounds 4% milk equivalent per cow	5,336	5,734	5,823	5,080
Per cwt. of milk:				
Concentrates (lb.)	33	37	25	26
Hay (lb.)	42	44	39	45
Silage (lb.)	31	23	70	30
Other roughage (lb.)	4	6	4	10
Pasture days	4.1	3.8	3.3	4.1
Man labor (hrs.)	3.3	2.8	2.5	3.0
Percentage of total cost contributed by above factors	74.6	76.9	79.6	83.1
Net cost per cwt. of 4% milk	2.22*	2.10*	1.92	1.91

*Adjusted to feed prices used in the 1934-35 study.

planation must be found elsewhere. The most probable explanation is that cows in the large herds had the greatest inherited producing ability.

Feed costs ranged from $66.60 per cow in small herds to $69.51 in medium and $75.34 in large herds. The higher cost of feed per cow in large herds, in spite of the feeding of smaller amounts, indicates that a higher quality of feed may have been used. This in turn may be a partial explanation of the higher production per cow.

The amount of labor used per cow averaged highest in the small herds and least in the medium herds. The cost of labor corresponded to the amounts used, averaging $29.05, $22.51, and $26.25, respectively, for small, medium, and large herds.

After noting the wide difference in the remaining other costs between low and high-cost herds, one finds the differences in costs between different sizes of herds insignificant. At first thought it might be expected that the distribution of necessary overhead expenses over a smaller number of animals would result in higher costs per cow for small herds, decreasing as the size of the herd increased. However, this tendency was counteracted by the building of more expensive barns and by use of a wider variety of equipment in the larger herds. The result was that costs other than feed and labor averaged $29.41 per cow in small herds, $31.26 in medium herds, and $26.65 in large herds.

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*Adjusted to feed prices used in the 1934-35 study.

Summary and Conclusions

The costs of producing fluid milk were determined for 36 herds in the Charleston and Huntington market areas for the 12-months' period beginning July 1, 1935. In the Huntington herds total costs per cwt. of 4% milk, f. o. b. the farm, were $2.20. Feed costs per cwt. averaged $1.14, or 52% of the total. Miscellaneous credits reduced the cost per cwt. of milk to a net amount of $1.94.

In the Charleston herds total costs were $2.26 per cwt., of which feed costs made up $1.32, or 58%. Miscellaneous credits reduced the net cost of production to $1.97 per cwt.

The average production per cow was 5,336 pounds of 4% milk in Huntington herds and 5,734 in Charleston herds.

Comparison of low and high-cost herds showed that high costs were due to less than average production per cow; too heavy feeding of grain that was too high in protein in relation to the roughage fed; and high costs for use of buildings and for other items besides feed and labor.

Producing ability of the cows kept, together with their management for high production, had so strong an influence on costs of production as to obscure the effect of size of herd.